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| 10/580,018   | 05/19/2006  | Johannes Bos                | 127898              | 7546             |
| 25944 7590 09/10/2010<br>OLIFF & BERRIDGE, PLC<br>P.O. BOX 320850<br>ALEXANDRIA, VA 22320-4850 |             |                             |                     |                  |
| EXAMINER<br>LSTVOYB, GREGORY   |             |                             |                     |                  |
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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/580,018  
Filing Date: May 19, 2006  
Appellant(s): BOS, JOHANNES

\_\_\_\_Jeremy D. Tillman\_\_\_\_\_

For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 11/16/2009 appealing from the Office action mailed 6/15/2009.

**(1) Real Party in Interest**

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The following is a list of claims that are rejected and pending in the application:

Claims 1-5 and 10.

**(4) Status of Amendments After Final**

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

**(5) Summary of Claimed Subject Matter**

The examiner has no comment on the summary of claimed subject matter contained in the brief.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

**(7) Claims Appendix**

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

**(8) Evidence Relied Upon**

|            |                  |         |
|------------|------------------|---------|
| 4308374    | Vollbracht et al | 12-1981 |
| 5646234    | Jung et al       | 7-1997  |
| RU 2017866 | Chernykh et al   | 08-1994 |

Encyclopedia of Pol. Sci and Tech "Polyamides", vol 3, p. 565-567, 2001

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

**Issue I**

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Vollbracht et al (US 4308374) herein Vollbracht in view of Chernykh et al (RU

2017866) herein Chernykh or Jung et al (US 5646234) herein Jung (all cited in the previous Office Action).

Vollbracht teaches a method for obtaining an aromatic polyamide containing para-phenylene terephthalamide in the form of a crumb, by polymerizing para-phenylenediamine and terephthaloyl dichloride in a mixture of N-methyl pyrrolidone(NMP) and containing calcium chloride (CaCl<sub>2</sub>).

Vollbracht teaches is an aromatic polyamide in the crumb form, which has a relative viscosity of at least 4 and the crumb is formed directly by the copolymerizing (see Example 1).

Vollbracht teaches that his polyamide can be used for fiber formation.

Vollbracht does not teach 5(6)-amino-2-(p-aminophenyl)benzimidazole and ratios between the monomers, which are suitable for crumb formation.

Chernykh discloses a method for obtaining a composition for fiber formation comprising an aromatic polyamide containing para- phenylene terephthalamide and 2-(p-phenylene)benzimidazole terephthalamide units by copolymerizing: i) a= 10-80 mole % of para-phenylenediamine; ii) b=10-80 mole % of 5(6)-amino-2-(p-aminophenyl)benzimidazole; and iii) 100 mole% of terephthaloyl dichloride (see Example 1).

Note that in the Example 1 Chernykh uses Cl-para-phenylenediamine, whereas Claim 1 claims para-phenylenediamine. However, Chernykh teaches that the above compounds are equivalent (see Page 7, line 15).

Also, Chernykh teaches that DMAA and NMP as well as LiCl or CaCl<sub>2</sub> can be equally used (see Page 3, line 25).

In a mixture of N-methyl pyrrolidone and containing 2.8-4.8% wt.% of calcium chloride or lithium chloride (see Table 2, column 2), a + b is 100 mole% and i), ii), and iii) together comprise 1-20 wt.% of the mixture (see Example 1), Based on the above data the result of b x c multiplication can be less than 215.

Intrinsic viscosity of the polymer above is between 5.9 and 10.9 dl/g (see Table 2), which meets the limitations of claim 1.

Jung discloses method of obtaining an aramid by polycondensation of 100 mol% terephthaloyl chloride, 40 mol% p-phenylenediamine and 60 mol% 5(6)-amino-2-(p-aminophenyl)-benzimidazole in N-methylpyrrolidone, wherein a+b=100 mol% and the relative viscosity is 4,3 (see example 8).

Jung discloses solubility-promoting additives such as calcium dichloride in amounts of between 0.2 and 10 wt.%, preferably between 0.5 and 5 wt.%, can be added to the polycondensation mixture (see column 3, lines 19-35 and 62-67).

Chernykh or Jung do not disclose a crumb obtained directly by copolymerization, since their processes are intended to directly process a solution into article immediately after synthesis.

5(6)-amino-2-(p-aminophenyl)benzimidazole is a common monomer for fiber-forming polymer. Typically this compound used when high temperature resistance or broad temperature range of application is needed. Also benzimidazole known for their fire resistance and good mechanical properties (especially tensile strength and modulus).

Relations between monomer content,  $\text{CaCl}_2$  and other technological parameters in order to obtain a crumb can be adjusted by an artisan with routine experimentation approach.

Therefore, it would have been obvious to a person of ordinary skills in the art to apply 5(6)-amino-2-(p-aminophenyl)benzimidazole comonomer in Vollbracht's fiber-forming polyamide, since it increases temperature application range, enhances mechanical properties and possesses an excellent fire resistivity.

Claims 2-5 rejected under 35 U.S.C. 103(a) as being unpatentable over Chernykh et al (RU 2017866) herein Chernykh or Jung et al (US 5646234) herein Jung (both cited in the previous Office Action) in view of Vollbracht et al (US 4308374) herein Vollbracht or Encyclopedia of Pol. Sci and Tech (Polyamides, vol 3, p. 565-567) herein Encyclopedia and the Applicant's Admission of the Prior Art in the Specification.

Chernykh discloses a method for obtaining a composition comprising an aromatic polyamide containing para- phenylene terephthalamide and 2-(p-

phenylene)benzimidazole terephthalamide units by copolymerizing: i) a= 10-80 mole % of para-phenylenediamine; ii) b=10-80 mole % of 5(6)-amino-2-(p-aminophenyl)benzimidazole; and iii) 100 mole% of terephthaloyl dichloride (see Example 1).

Note that in the Example 1 Chernykh uses Cl-para-phenylenediamine, whereas Claim 1 claims para-phenylenediamine. However, Chernykh teaches that the above compounds are equivalent (see Page 7, line 15).

Also, Chernykh teaches that DMAA and NMP as well as LiCl or CaCl<sub>2</sub> can be equally used (see Page 3, line 25).

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Jung discloses method of obtaining an aramid by polycondensation of 100 mol% terephthaloyl chloride, 40 mol% p-phenylenediamine and 60 mol% 5(6)-amino-2-(p-aminophenyl)-benzimidazole in N-methylpyrrolidone, wherein  $a+b=100$  mol% and the relative viscosity is 4,3 (see example 8).

Jung discloses solubility-promoting additives such as calcium dichloride in amounts of between 0,2 and 10 wt.%, preferably between 0,5 and 5 wt.%, can be added to the polycondensation mixture (see column 3, lines 19-35 and 62-67).

Chernykh or Jung does not disclose a crumb obtained directly by copolymerization, since their processes are intended to directly process a solution into article immediately after synthesis.

Regarding Claims 4 and 5, Encyclopedia discloses a process of obtaining Poly(p-phenylene terephthalamide) in of N-methyl pyrrolidone at the presence of Calcium Chloride. Encyclopedia teaches a process for making a purified aromatic polyamide,

which comprises coagulating and washing the crumb in water, followed by drying step (see pages 565 and 567).

Vollbracht teaches a method for obtaining an aromatic polyamide containing para-phenylene terephthalamide in the form of a crumb, by polymerizing para-phenylenediamine and terephthaloyl dichloride in a mixture of N-methyl pyrrolidone and containing calcium chloride.

Vollbracht teaches is an aromatic polyamide in the crumb form, which has a relative viscosity of at least 4 and the crumb is formed directly by the copolymerizing (see Example 1).

Vollbracht teaches that his polyamide can be used for fiber formation.

Chernykh or Jung does not teach the polymer precipitation step, since synthesis of polymer and its processing locates in one facility. However, more commonly those two processes are separated. In this case it is economically efficient to transport and store dried polymer instead of its diluted solution in N-methyl pyrrolidone.

Therefore, it would have been obvious to a person of ordinary skills in the art to precipitate Chernykh's or Jung's polymer using Encyclopedia's and Vollbracht's technology in order to expand applicability of the polyamide.

Chernykh or Jung and Encyclopedia does not disclose the crumb is defined as non-sticky particles at least 95% of which having an average diameter of 0.7-15 mm.

However, according to Applicant's discussion of the Prior Art in the Specification, such crumbs are known from the process of preparing of fully aromatic polyamides based on e.g. PPD and TDC, which products are known under the trade names Twaron® (Teijin Twaron) and Kevlar (DuPont). After polymerization in NMP/CaCl<sub>2</sub> a crumb is obtained which can be easily coagulated, washed, and dried, and the product obtained can be dissolved in sulfuric acid and shaped into a desired form, like fibers or films.

The crumbs of the above particles are very process-friendly, in particular, in a filtration step. The efficiency of the above step can be impaired with fines or sticky gels. Polymer precipitation aiming the crumbs with particular particle size can be achieved with well known technological approaches (rate of precipitant adding, temperature, stirring, etc).

Therefore, it would have been obvious to a person of ordinary skills in the art to obtain crumb with optimum particle size (i.e. 0.7-15 mm) in order to achieve efficient filtration process.

It is noted that there is no showing of unexpected results, associated with particular particle size range in the Specification.

#### **(10) Response to Argument**

**Issue I**

Appellant argues that "The Examiner's contention that the relationship between materials (i.e., monomers and salts) used to form a crumb can be adjusted by routine experimentation (Facts 37-39) is incorrect (Fact 40). The Examiner has incorrectly theorized how to form a DAPBI PPTA aramid crumb (Facts 41-43) and incorrectly analyzed the unexpected nature of forming a DAPBI PPTA aramid crumb (Facts 44-45). For at least these reasons, the Examiner's contention is factually incorrect and contrary to the evidence of record".

Examiner disagrees. It is clear that solubility of the polymer depends on its structure. Relations between monomer content,  $\text{CaCl}_2$  and other technological parameters in order to obtain a crumb can be adjusted by an artisan with routine experimentation approach.

In particular, Appellant argues that the claimed composition does not contain any precipitant (see Fact 41 on page 17 of the Appeal Brief).

However, it contradicts the basic principles of the polymer solution theory.

In this particular case there is a three component system, i.e. polymer (DFARBI PPTA), solvent (NMP) and additive ( $\text{CaCl}_2$ ). At given structure and molecular weight, the polymer solubility depends on concentration of the polymer and the additive. Varying the parameters above within routine experimentation approach, a phase diagram can be built.

In all cases (with or without PPD or DARBI) crumb formation strictly dictates by solubility of the polymer in a system. Therefore, crumb can be formed in both cases varying

solvent/non-solvent concentration (i.e. NMP/CaCl<sub>2</sub> ratio), depending on the polymer structure. In other words, polyamide, based on PPD can remain in the solution if the concentration of a precipitant is not sufficient.

Appellant submits that Chernykh and Jung do not describe any way to form a DAPBI PPTA aramid crumb, or provide any suggestion as to what of a myriad of possible conditions might be modified to possibly form a crumb.

Chernykh discloses a method for obtaining a composition comprising an aromatic polyamide containing para- phenylene terephthalamide and 2-(p-

phenylene)benzimidazole terephthalamide units by copolymerizing: i) a= 10-80 mole % of para-phenylenediamine; ii) b=10-80 mole % of 5(6)-amino-2-(p-aminophenyl)benzimidazole; and iii) 100 mole% of terephthaloyl dichloride (see Example 1).

Jung discloses method of obtaining an aramid by polycondensation of 100 mol% terephthaloyl chloride, 40 mol% p-phenylenediamine and 60 mol% 5(6)-amino-2-(p-aminophenyl)-benzimidazole in N-methylpyrrolidone, wherein a+b=100 mol% and the relative viscosity is 4,3 (see example 8).

Therefore, Chernykh or Jung disclose all the components claimed (DAPBI PPTA, NMP and CaCl<sub>2</sub>), but not disclose a precipitation step, which is disclosed in the primary reference.

Appellant argues that "The composition and method disclosed in Example 1 of Chernykh are different from the composition and method recited in the present claims.

Fact 26. Thus, the mole percent sum of the independent claims (a + b) using the data of Example 1 is only 60 mole percent (a=0, b=60) and not 100 mole percent as recited in the independent claims. Fact 26"

This is incorrect. In order to obtain polymer of reasonable molecular weight, the ratio between diamines and terephthaloyl dichloride should be close to stoichiometric ratio. In all examples of Chernykh the sum of diamines in mols) is equal to ones of terephthaloyl dichloride (see Example 1 of Chernykh, page 5, line 5).

Appellant argues that Jung requires the addition of a solubility promoting additive.

However, Appellant admits that those additives are  $\text{CaCl}_2$  or  $\text{LiCl}_2$  (see Fact 28). However, the same additives used in the Application examined for the same purposes (i.e. regulate solubility of the polymer).

Applicant submits that " The Rule 132 Declaration prepared by Mr. Bos (Facts 30-32) has effectively demonstrated that forming a DAPBI PPTA aramid crumb directly during the copolymerization of PPD, DAPBI and TDC monomers is not a matter of routine experimentation because the result of replacing a portion of DAPBI with PPD is entirely unpredictable and requires "a highly significant combination of properties." Fact 44 and Fact 62".

Examiner disagrees. Mr. Bos provides set of routine experimentations typically used for such purposes. However, experimentations provided are not commensurate with the scope of the claims 1 and 2. For instance, only two concentrations of the salts

(i.e. 10.71 and 8.65%wt, see Table 2 of the Declaration) ) was used for both LiCl and CaCl<sub>2</sub>, which is not sufficient for demonstration of unexpected results. In opposite, Chernykh broadly varies the salt concentration (2.8-4.8%, see Table 2, page 11).

Appellant argues that as it shown by Mr. Bos in the Declaration, LiCl and CaCl<sub>2</sub> behave differently in crumb forming solution.

However, both Chernykh and Jung clearly disclose CaCl<sub>2</sub> in their disclosures. In addition, Mr. Bos used only two salt concentrations (i.e. 8.65 and 10.71%), which is not sufficient for such comparison.

In declaration Mr Bos states that no polymer of high inherent viscosity can be formed when LiCl is used.

This is incorrect. In Table 3 (see page 7 of the Declaration), Mr Bos demonstrates that the viscosity at the presence of CaCl<sub>2</sub> is within the range of 0.43-0.63 dl/g, whereas with LiCl it is within the range of 0.41-0.57 dl/g. Thus, intrinsic viscosities in both cases are at the same range.

Appellant submits that Encyclopedia does not describe replacing a portion of the PPD with DAPBI.

However, Chernykh and Jung both teach the systems having such a combination of the reagents.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

Respectfully submitted,

/GREGORY LISTVOYB/

Examiner, Art Unit 1796

Conferees:

/James J. Seidleck/

Supervisory Patent Examiner, Art Unit 1796

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